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VALLEY OF THE DINOSAURS

Prepared by Dr. W. R. READ

A visitor approaching the city of Drumheller is suddenly confronted by a mile wide valley where the Red Deer river has excavated below the prairies of Central Alberta to a depth of nearly four hundred feet. Traveling from Calgary via No. 9 Highway the first intimation of an abrupt change in terrain occurs at Horseshoe canyon lookout ten miles south-west of the city of Drumheller. Horseshoe Canyon is only tributary to the Red Deer valley and the scenery here is but a preview of the magnificent vistas that await in the main canyon between Drumheller and Trochu ferry. The grandeur of the multi-colored, sculptured walls of the valley, as viewed from the Dinosaur trail between Drumheller and Munson ferry, is unexcelled elsewhere in Canada. Here are the world famous Badlands of Alberta.

The Red Deer Valley is the result of erosion. The Red Deer river has required only a few thousand years to carve the badlands, but in the process it has revealed a chapter in the history of the earth that was written in the rocks seventy-five million years ago and when deciphered by geologists rivals the best of science fiction.

FOSSILS LIFT THE VEIL OF TIME

Life on our earth has passed through many stages between its birth in the remote past and its present day expression. Great races of creatures arose and flourished for many millions of years and became extinct leaving only their remains as mute evidence of their existence. These remains are called fossils and they comprise bones and tracks of ancient animals, as well as impressions of leaves and petrified wood buried in the rock of the earth's crust.

Although fossil remains were known to exist as early as 450 B.C., for many centuries they were deprecated as devices planted by the devil to delude man. Another conviction held was that fossils were "relics of that accursed race that perished with the flood." But by the turn of the 19th century a few pioneer students of the earth, geologists (the early geologists were more stone masons than scientists) noticed that a relationship existed between certain layers of rocks and the fossils which they contained. Each layer seemed to have its own characteristic plant and animal remains. These men began to sense dimly vast expanses of time punctuated here and there by profound changes in life, topography and climate. Slowly they began to piece together the petrified bits and pieces into a picture of the life of millions of years ago. Thus was born the science of paleontology, the study of ancient life. Paleontology is an adjunct of geology, the broader science that investigates the structure and history of the earth and in a practical way discovers and exploits all kinds of economic mineral resources including oil, coal, iron and gold and so on.

There are many things of interest in the Red Deer valley for the geologist. For the paleontologist the badlands are a veritable storehouse of fossils which is easily accessible to the amateur fossil hunter as well as the professional collector. A few hours spent exploring the coulees of the valley will prove stimulating and rewarding to anyone who follows the dinosaur trail and visits the local museum.

This earth is perhaps three billion years old. So far as paleontologists can tell the first living things appeared on earth about two billion years ago. For a long time after that, possibly one and a half billion years the only animals were relatively insignificant creatures such as sponges, jellyfish, snails, clams, worms and crab-like beasts, but no animals with back-bones appeared until about four hundred million years ago. These first animals with back-bones were the fishes which were soon followed by creatures that could breathe air and spend part of their lives out of the water, in other words: amphibians, whose living descendants are the frogs, turtles and salamanders. A little later some amphibians became entirely divorced from their life in the water, developed dry, scaly skins and thus became the first reptiles.

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The reptiles soon dominated the land and ushered in the Age of Reptiles. This age is known technically as the Mesozoic Era and lasted about 130 million year. It came to a close about 65 million years ago with the final extinction of the great dinosaurs and most of their lesser allies. Of the reptiles only the turtles, lizards, snakes, crocodiles and the tuatara have survived to modern times. The Age of Mammals in which we live followed the demise of the dinosaurs. The great Ice Age, of which we speak so glibly in terms of long ago, in fact occurred within the last million years and according to some is still with us.

Where in this long history do the rocks in the Red Deer valley fit and how did they come to be?

GEOLOGY

The most abundant rocks in the valley walls are composed of alternate bands of black, brown, grey and white layers of coal, clay, ironstone, shale and sandstone. These rocks are called the Edmonton formation by geologists and the fossils they contain tell us that they date from near the end of the Age of Reptiles, a time known to geologists as the Cretaceous Period. In a few places light grey yellow cliffs can be seen above the darker coloured Edmonton rocks and these belong to the Paskapoo formation which was laid down some 60-65 million years ago at the beginning of the Age of Mammals. Still higher in the bluffs, right up to the prairie's edge and "on top" are yellow gravels, sands and silts which date from sometime in the great Ice Age or Pliocene Epoch. These sediments are only a few thousand years old and evidently formed in lakes that lay upon the land when the broad glaciers were melting away. The regularly banded yellow silts which can be seen along the highway as it begins its descent towards Drumheller were deposited in old Lake Drumheller which is estimated to have covered an area of approximately eleven hundred square miles. Lake Drumheller was dammed by glacial ice that melted more slowly to the south, but when the ice dam finally disappeared the old lake was drained and the final sculpturing of the Red Deer valley commenced. This occurred only a few thousand years ago. The rim of hills at the prairie level are composed of sand and gravel that was dumped from glacial streams as the melting ice caused their channels to collapse.

What occurred between the end of the Age of Reptiles and the Ice Age is little known in the Drumheller district. Sediments probably continued

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to be deposited here off and on for the 65 million years of the Age of Mammals, but the glaciers so gouged the surface of the earth that they carried away mile after mile of more recent rocks. Thus was destroyed most of the record in the rocks except those from the very earliest times in the Age of Mammals, which are still preserved in the Paskapoo formation.

THE EDMONTON FORMATION

The colourfully banded layers of the Edmonton formation were deposited by meandering rivers in shallow lakes and lagoons and flood plains. Layer upon layer of mud, clay, silt and sand piled up over thousands of years to a depth of hundreds of feet. In the ensuing millions of years these sediments were cemented and compacted into the hard rocks they are today.

It is a distinctive feature of these rocks that they contain large quantities of the mineral bentonite which is derived from the chemical weathering of volcanic ash. At times, thin but very extensive layers of white volcanish ash were apparently deposited directly in shallow bodies of water covering much of the Central Alberta and Saskatchewan region. This material called the Kneehills tuff in the Drumheller area is very hard and forms a thin white "cap rock" at the rim of Horseshoe canyon. According to geologists the ash itself was evidently spewed out of volcanoes which erupted to the south in what is now the state of Montana.

Most of the sand and mud that forms the Edmonton formation was derived from the erosion of highlands to the west. The Rocky Mountains had begun to rise in the closing phases of the Mesozoic Era (Age of Reptiles) under the influence of what seems an almost unimaginable warping of the American continent. Off and on for hundreds of millions of years a vast inland seaway had joined the Gulf of Mexico and the Arctic Ocean across what now are the prairie states and provinces. Some deposits from this arm of the sea called the Bearpaw formation can be seen south-east of Drumheller where brown shales form the base of the stems of the Hoodoos at Willow Creek. Fossil oyster shells in the Edmonton formation are apparently derived from this inland sea which briefly inundated some of the lowlands at several times during deposition of the Edmonton sediments.

At the very end of the Age of Reptiles the warping of the continent combined with erosion to cause the final retreat of this great seaway from North America. By this time the last of the Edmonton rocks had been deposited.

The Edmonton formation is of great interest because of the wealth of dinosaur bones which it contains. But dinosaurs are not the only fossils in these rocks. Also present are remains of various less spectacular creatures including sharks, alligators, gars and other fishes, salamanders, turtles, lizards, crocodiles and an almost unbelievable sea-monster called a plesiosaur. At several places there are layers of ancient oyster shells and besides coal deposits there are remains of a great variety of plants and petrified tree trunks.

ALBERTA 70 MILLION YEARS AGO

Scientific analysis of the geological and paleontological evidence afforded by the Edmonton formation and its fossils permits the following impressions of what Alberta was like some 70 million years ago.

Where flat prairie land now rises gradually toward the ancient Rocky Mountains a broad swampy delta formed along the edges of the inland sea that stretched north-westward from the Gulf of Mexico. Where the Red Deer river now cuts its canyon there were then broad and meandering streams, with backwaters bordering on the stagnant, which in places produced swamps where vegetation decayed in the first stages of coal formation. These lowlands were periodically flooded and occasionally for several years at a time the sea drowned some of the river mouths. Wide savannas reached inland onto higher ground.

Where now temperatures range from 110 degrees above zero to 50 degrees below and the countryside is swept unmercifully by winter blizzards, the climate was then uniformly sub-tropical and the ground never froze in the winter. Where now trees worthy of the name exist only in

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For Map and Literature Write

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sequestered places, then there lived a "forest primeval" composed of tall redwoods, cypresses, sable palms, plane trees, ginkos and others that today occur only in subtropical climates.

In this setting instead of herds of cattle, sheep and occasional families of antelope there lived hordes of armoured and duck-billed dinosaurs. The variety of these creatures is almost beyond imagination. Armoured dinosaurs resembling horned toads as big as trucks moved sluggishly about the countryside. Fleeter dinosaurs the size of ostriches ran about on long hind legs in search of seeds, flies insects or perhaps eggs. Always in the background lurked the possibility of sudden crushing death administered by gigantic carverous dinosaurs which were among the most devastating destroyers nature has ever devised. Streams and Lakes were populated, in addition to the ubiquitous duck-bill dinosaurs, by crocodiles, turtles and fishes, many of which were possibly indistinguishable from their descendants in the present day everglades. And in the trees or wherever else protection could be had from the fearsome brutes of the reptile world, there lived the tiny possum-like creatures, "the advance guard" of the furry minions destined a few million years hence, to inherit the world.

DINOSAUR DISCOVERIES

The most famous petrified remains found in the Drumheller Badlands are the dinosaur bones. While one may find abundant petrified wood, fossil shells, berries, cones and even whole beds of fossil oysters, it is the dinosaur remains that have made the area famous among paleontologists the world over.

In the summer of 1884, Dr. J. B. Tyrrell was dispatched by the Dominion Geological Survey to investigate reported occurrences of coal in the Red Deer river valley. While thus engaged he discovered the head of a petrified monster exposed in a hillside near Kneehill Creek. Dr. Tyrrell sent this and other specimens to Ottawa and Philadelphia for study, and as is usual in scientific research the results of the study were not published until several years afterwards. In 1897 the Drumheller district was visited by a paleontologist, Mr. Lawrence M. Lambe, of the Geological Survey of Canada. In 1910, Barnum Brown of the American Museum of Natural History of New York led the first organized expedition for dinosaurs into the valley between the Trochu ferry and the city of Drumheller. He returned in 1911 and in 1912 to complete his work in the Edmonton formation, and in the three years collected an exceptionally fine series of dinosaur skeletons and skulls. In 1912 also, the world famous fossil hunter, Mr. Charles H. Sternberg explored the area accompanied by his sons, Levi, Charles M. and George. On August 12th of that year, Charles M. Sternberg discovered a large duck-billed dinosaur skeleton on Michichi Creek which was later assembled at the National Museum in Ottawa and became the first dinosaur skeleton to be mounted in a Canadian museum. Al-

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though C. H. Sternberg continued to search for dinosaurs in the Canada fossil fields for several years, he never returned to the Drumheller district. His three sons, however, conducted no less than thirteen expeditions in the general vicinity of Drumheller, Munson, Morrin, Trochu and Ardley. By far the most frequent visitor to the district was Dr. Charles M. Sternberg who between 1923 and 1947, conducted six expeditions into the valley on behalf of the National Museum of Canada.

As recently as 1955-56 a dinosaur skeleton was excavated by the National Museum of Canada near Munson ferry and although the specimens are perhaps less easily discovered now than in earlier years, there is no evidence that the supply of fossils in the valley is becoming exhausted.

Since the first discoveries were made three quarters of a century ago nearly thirty fairly complete dinosaur skeletons have been obtained from the Red Deer Valley north of Drumheller. Many of these were new to science and have been duly recorded in technical literature that runs to many hundreds of pages.

The best collection of dinosaur skeletons and skulls from the Drumheller districts may be seen in the Royal Ontario Museum in Toronto, the American Museum of Natural History in New York and the National Museum of Canada in Ottawa. Skulls and partial skeletons of other "Drumheller" dinosaurs are preserved in the Chicago Natural History Museum, the British Museum of Natural History in London, and in several North American and European university collections.

DINOSAURS

Cold stone fossil beds tell us nearly all we know about the dinosaurs. These extinct reptiles however, were once the dominant wild animals throughout about 130 million years of earth history. The last of them died perhaps 65 million years ago when the warm blooded mammals finally inherited the earth.

The first dinosaurs evolved from small alligator like beasts some 200 million years ago. At first, the dinosaurs were small slender bodied animals quite different from the gigantic behemoths of later times. The first dinosaurs were probably flesh eating animals, but eventually some of these became more omnivorous in diet and later some of these became specialized to an herbivorous diet. The first dinosaurs were evidently bipedal animals, but when as a group they became heavier of body they tended to walk on all fours as their distant ancestors have done. A few dinosaurs, both of the herbivorous and carnivorous kinds, later became bipedal again; in fact it is not certain that the carnivorous dinosaurs ever passed through a completely quadrupedal stage in their evolution.

During the Age of Reptiles, the dinosaurs and their allies managed to become fitted for making a living in almost every conceivable fashion that was available on the earth of their time. For example; while dinosaurs ruled the land some other reptiles took to the sea and others even invaded the air spaces to become the well known Pteradactyls.

The greatest part of the Age of Reptiles had already passed before the Edmonton formation was deposited in Alberta. Most people think of dinosaurs as huge four-legged creatures with long necks and tails and tiny heads, but in fact this kind of dinosaur called sauropods had largely disappeared before any of the Canadian dinosaur beds were deposited. True sauropods still lived in the southern hemisphere and even in the southern parts of the United States (albeit in small numbers), but no remains of sauropods have ever been found in Canada, nor are they likely to be found here.

Many different kinds of dinosaurs however, did exist in the region now traversed by the Red Deer river. Those from the Drumheller district can be grouped roughly into the carnivorous and herbivorous kinds. As usual in nature there were fewer carnivorous than herbivorous ones and these consisted of huge bipedal beasts 35 feet in length and of smaller animals perhaps no larger than a good sized dog. Of the smaller varieties we know very little because their fossil remains are rare and when found consist usually of teeth and isolated broken bones. The larger carnivorous dinosaurs were exemplified by *Albertosaurus* which was an ancestor of the world famous *Tyrannosaurus rex*.

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DRUMHELLER — ALBERTA

Albertosaurus had a short neck and body, a long tail, huge head with a mouth full of sabre-like teeth four inches long and powerful hind legs with feet which resembled those of a turkey. The front legs were by contrast so small as to appear practically without function.

Constructed along similar lines but more slender of body and only about nine feet in length were the ostrich mimic dinosaurs called **Struthiomimus**. Its bone structure tells us that Struthiomimus was a true carnivorous dinosaur by descent but it had become adapted to another mode of life. Instead of the powerful jaws armed with fearsome teeth its feeding mechanism was weak and teeth had been replaced with a horny bird-like beak. Its neck was relatively long and slender. Its hindlegs were long and slender. The front legs were longer in proportion than they were in its larger carnivorous colleagues. The food of Struthiomimus is somewhat of a mystery. Perhaps it consisted of fruits, berries, insects, eggs, either one or all. One thing is certain, it was a very agile and swift moving animal which resembled an ostrich without feathers.

The plant eating dinosaurs can be divided into several groups including the duck-billed, horned, armoured and others.

The duck-billed dinosaurs were by far the most common animal of their day in the Drumheller district. One species called Edmontosaurus was nearly 30 feet long. It had a long tail, which was flattened from side to side, heavy hind limbs, short front legs and a moderately long and slender neck. Its head was not unusually small as dinosaur heads go and the jaws contained batteries of specialized teeth. There were perhaps a thousand or more teeth present in the mouth of a single animal, although only around two hundred of these were in use at any one time during its life. The other teeth were held in reserve and came into use as the ones above them were worn off. As the name implies, the duck-billed dinosaurs have a peculiar toothless snout which when viewed from different angles reminds one of the bill of a duck. These animals were presumably sluggish beasts which spent most of their time in pools of the great Edmonton delta, both in order to escape the fearsome Albertosaurus and also literally to take the weight off their feet. These animals weighed several tons and the bones were constructed so that probably they could not support the weight of the body on dry land for very long at a time. Usually, skeletons of the duck-billed dinosaurs are found laying on their sides with the head thrown back, the forelimbs dangling in front of the body, the tail extended out in a more or less straight fashion behind and the legs strongly flexed suggesting a swimming position. In many cases we have found impressions of the skin preserved in the rocks around their bones so we know that the hide of the duck-billed dinosaur was composed of scales which were arranged in various ornamental way. We do not of course know anything about the colour of the 'skin' or of the colouration of any other dinosaur for that matter.

Edmontosaurus was not the only duck-billed dinosaur of this region. There were other, both larger and smaller, which had strangely developed heads. Whereas the bodies of the duck-billed dinosaurs were pretty much alike, the tops of the heads of the different species differ greatly from one another. For example, the head of Edmontosaurus was flat on top but some of its close relatives had greatly swollen foreheads and one had a long spike that projected backwards above the neck.

Typical of the horned dinosaurs were the swamp-dwelling creatures called **Anchiceratops**. This animal was not quite as large as an elephant but probably weighed a couple of tons. It walked on four massive legs of which, (as in all dinosaurs) the hind ones were much longer than those in front. The tail was short for a dinosaur and was possibly carried off the ground. There was practically no neck, in fact some of the bones in the neck had solidified into a single mass in order to strengthen the support for the gigantic head. Anchiceratops and the other horned dinosaurs were unusual among dinosaurs in having heads of tremendous size. In Anchiceratops the head accounted for almost a quarter of the length of the animals' body. It consisted of a sharp hooked beak that resembled that of a turtle, a fairly long face and behind, a broad sheet of bone formed an ornamental shelf of frill that projected over the shoulder region. There was

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a small horn on top of the beak above the nose and a larger one over each eye. The teeth resembled those of the duck-bill dinosaurs, but were less numerous. The jaws were extremely powerful.

Whereas the duck-billed dinosaurs were evidently defenceless away from the water, the horned dinosaurs presumably could give a good account of themselves in any encounter with *Albertosaurus* or his unfriendly relatives. For, not only did the bony frill behind the head protect the front part of the body from frontal attack, the horns bore at the unprotected belly of the great flesh-eaters, which it will be recalled walked on their hind legs with the front part of the body well elevated.

There were many different kinds of 'horned dinosaurs' (some of which it may be noted did not have horns) but not many are found in the Drumheller area. A very small species has been found upstream from the town or Trochu and the ancestors of the famous **Triceratops** is known to occur in the Edmonton rocks near Morrin ferry.

The other great group of dinosaurs were the armoured forms. Imagine a modern day "horned toad" 20 feet long and five or six feet wide and you will have a fair idea of what these pre-historic tanks must have looked like in life. Their bodies were low and broad and supported by pillar-like legs, which instead of long slender toes and claws had feet that probably resembled large land tortoises of today with stubby hook-like ends of the toes. The upper side of the body was covered with a mosaic of horny plates and along the sides were curved spikes which became very large and heavy in the region of the shoulders. The heads of armoured dinosaurs were small and completely covered with thick bony plates above and on the sides. The tail was long and so stiffened by bony rods along the sides of the vertebrae that it was evidently rigid at least in its back portion. At the end of the tail were large almond shaped chunks of bone which fitted together to form a club-like structure. This tail in life must have resembled a gigantic mace. One can imagine that such a creature was partly immune to attacks by *Albertosaurus*; when danger threatened it may simply have squatted down and swept its tail back and forth in a broad arc behind it. Conceivably the tail club could have cut the feet of a carnivorous dinosaur completely out from under him. In this connection it is interesting to note that many shin bones of carnivorous dinosaurs show the results of severe injuries during life.

Many armoured dinosaurs had their teeth greatly reduced in size and numbers and evidently depended on a horny beak and tough cheek pads to obtain their food which consisted probably of low, soft leafy plants.

All of these dinosaurs lived in or close to bodies of water. They were lowlanders. On higher ground there existed other dinosaurs about which we know very little because their carcasses seldom were buried where they could become fossils. One that is worthy of mention is the bony headed dinosaur; **Stegoceras**. The roof of the skull was composed of a great sphere of solid bone, the function of which is still a mystery to paleontologists. The skull bones are fairly common fossils because they were so solid they have resisted disintegration better than the rest of the skeleton which was a fairly delicate affair. The *Stegoceras* was not a large dinosaur, possibly a length of no more than three feet.

So much for the common dinosaurs of the Drumheller valley. There were others but we know very little about them. They were relatively insignificant in number. Many and varied ancestors of these Drumheller dinosaurs are found as fossils elsewhere in Canada. The famous *Triceratops* and *Tyrannosaurus* which are descended from dinosaurs from the Drumheller area are known to occur further upstream on the Red Deer river. These animals were among the very last of the dinosaurs and as yet no very complete specimen of either has been discovered in Alberta.

HOW ARE DINOSAUR SPECIMENS COLLECTED?

It is a popular misconception that the fossil hunter finds his bones by digging for them. Nothing could be more futile. The proverbial needle in the haystack would be much easier to discover than a dinosaur in the Drumheller valley if this were the method employed by paleontologists. Fortunately the fossil hunter has the assistance of Mother Nature and the processes of erosion expose the fossil bones to view in just the same way

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as it exposes the rocks which surrounds the fossils. When the paleontologist enters an area of erosion his eyes are glued to the ground, while he prospect for fragments of broken fossil bone that have been brought to the surface through the various processes of erosion. Usually, when such fragments are discovered careful investigation will lead only to the discovery of a piece of a bone; a vertebra or two, possibly a leg, a foot, a skull, but only occasionally does such a prospect lead to the discovery of a complete skeleton. It may require many days, weeks or even months of tedious prospecting to discover a complete dinosaur skeleton such as those to be seen on display in many large museums all over the world.

At some places there occur accumulations of bones of dinosaurs and other animals piled helter skelter in a fairly restricted area. These deposits are known as bone beds and may not contain material that is suitable for museum displays. A well exposed bone bed of this type occurs east of Morrin ferry. There are others on the west side of the Red Deer river north of Munson ferry. These bone beds apparently resulted from the washing about of decaying dinosaur carcasses on the shores of ancient bodies of water and they indicate that for some reason a large number of animals died at approximately the same time.

Once a favourable prospect has been discovered a great deal of work in the form of physical labour is required to remove the specimen from its burial place to the museum. This may require excavation with shovels and picks. Sometimes even dynamite judiciously employed is brought into play. It may be necessary to remove tons of rock from above the skeleton in order that the paleontologist may uncover the bones and once the excavation has progressed to the point where the bones are almost exposed then the heavy tools are discarded in favour of such implements as small awls, hammers and chisels, whisk brooms and paint brushes and the like. The bones of the skeleton are outlined with these more delicate implements and as each new area of bone is exposed to the air it must be treated immediately with solutions such as shellac which will harden the bone and protect it against the drying effects of the atmosphere. This may sound strange if the bones are actually petrified or turned to stone, but as a matter of fact freshly exposed fossil bones are often most brittle and soft and the drying effects of the air produces very unfavourable results in many cases. Of course the bones cannot be completely freed from the rock in the field. This is a time consuming operation that can only be accomplished in the museum laboratory.

As soon as the bones have been fairly well exposed on the upper side, trenches a foot or so wide are dug all around the bones so that in effect the bones are left resting on a pedestal of the original rock. Then the bone exposed in the upper side of the pedestal is covered with wet tissue paper,

(Continued on Following Page)

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and on top of the wet tissue paper are laid bandages made of strips of burlap dipped in plaster of paris and wrapped on in much the same fashion as a doctor would place a plaster cast on a broken arm. If the bones are large it may be necessary to emulate the doctor more closely by employing splints which are usually made of any sort of wood that can be obtained in the vicinity of excavation. As soon as the plaster jacket on the upper side of the pedestal has hardened the rock is cut away from the under side and the plaster jacket containing the bones and upper part of the pedestal is turned over and the same procedure is repeated on the under side. The result of this work is a fossil bone completely encased in a plaster of paris cast which, if it is properly made, should protect the bone during its transportation from the field to the museum and the bone should arrive at the museum in the same state of preservation in which it was removed from the ground. Once the fossil has been received in the museum laboratory the upper half of the protective plaster is cut away and the bone is again hardened and strengthened by the application of various solutions. The rock that still remains adherent to the bone is carefully chipped, scraped or ground off. The broken pieces of bone are removed and cleaned and then are fastened back together with various types of glue and plaster. In the case of long bones sometimes it is desirable to drill holes through the centres and insert iron rods, wires or some other means of strengthening the fossils internally and then they are put together with plaster. This procedure is referred to as preparation. After the fossil bones have been prepared they are then studied, identified and classified by the paleontologist. If they are of scientific interest the paleontologist usually prepares a highly technical report which is published in some professional journal and announces to the scientific world the discovery of a new creature or some interesting fact about an extinct animal that had not been previously known to science.

If the specimen is exceptionally good it may then be placed on display in a museum where the public as well as the scientist can take advantage of it and this is the way in which the magnificent dinosaur skeletons in many of the world's large museums have come to reside in exhibition halls. In mounting a dinosaur skeleton a tremendous amount of work is involved from a purely engineering point of view. Because the bones are extremely heavy and at the same time are exceedingly fragile it is necessary to support them on iron work or scaffolding which must be fashioned very carefully so as to fit the irregular configuration of the dinosaur bones and at the same time detract as little as possible from the skeleton itself. Mounting a large dinosaur skeleton in this fashion may require the complete efforts of one or two men for periods of two, three or even more years. If, as is usually the case the specimen is not completely represented, since part of the animal's skeleton may have been carried away before the carcass was buried and part of it may have been destroyed by erosion before the skeleton was discovered by the paleontologist some missing parts of the skeleton may have to be reconstructed in plaster of paris. This is a quite legitimate solution to the problem because otherwise, even though the scientist may have a good idea of what the complete structure of the animal looked like, the laymen may not be able to understand the structure of the animal if, for example, the skeleton was mounted with only three legs and only the back half of the tail with nothing in between it and the rest of the body. So these missing parts are frequently reproduced in plaster using either bones from the opposite side of the same skeleton as a guide, or else using bones from skeletons of other individuals of the same or very closely related species. In this way the public is assured of the accuracy of the reconstruction, and need not fall prey to the sometimes heard exclamation in museums, "After all they make these things out of plaster." This is not the case!

WHAT KILLED THE DINOSAURS?

It is impossible to state definitely what caused the extermination of the dinosaurs. It is also impossible to state whether a single factor was operative or a combination of many.

(Continued On Following Page)

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Perhaps the most general explanation would be that these great animals were unable to adapt themselves to changing conditions. They may have succumbed to other more progressive animals. They were cold blooded, sluggish, with a small and lowly organized brain in comparison to their bulk, which may have made it difficult for them to compete with more efficient warm blooded mammals which appeared at the end of the Cretaceous period. Small mammals could also have preyed upon their eggs.

There may have been other changing conditions in their environment such as a sudden climatic change, perhaps a flood, perhaps a suffocating blizzard of volcanic ash and gas. A change in food supply may have been an important factor and food supply change may have been brought about to some extent by alteration in climate which also could have affected the dinosaurs, but probably affected the type of vegetation. Perhaps the draining of the lowlands was another factor. The great problem in explaining the extinction of any group of animals lays in the fact that an explanation that would account for the extinction of any one animal or one small association of animals may not be sufficient to account for the extinction of the really great variety of creatures which actually occurred. There is no really good explanation of extinction that would account for the disappearance of the dinosaurs on land, the flying reptiles in the air and the marine reptiles in the water.

It is believed that a race or order can become old and weak in the same way as an individual. This is called racial senescence. This is often accompanied by overspecialization. During the closing years of the Cretaceous period the number of species and individuals gradually became fewer, although more highly specialized and gigantic. Large, specialized forms are easily exterminated if subjected to a change in habitat or food supply.

It should be born in mind that these extinctions did not occur instantaneously or overnight, so to speak. They were long drawn out affairs which took probably millions of years to accomplish, that is speaking of the reptiles as a whole. Of course it was quite likely that local extinctions may have done away with all the dinosaurs in a specifically restricted area in a brief period of time.

If these animal's physiology was anything like that of the diving reptiles, just a simple hard freeze of two or three days duration would have been sufficient to kill them off. Certainly, too, a very brief period of exceeding heat would have accounted for the death of all the creatures that could not protect themselves from this heat, and this of course in the absence of water would have included practically all the dinosaurs, because after all it would be petty hard for a dinosaur to crawl under a rock or dig a hole to get out of the direct rays of the sun, as modern reptiles and the little lizards in the deserts are able to do. As a matter of fact the lizards and snakes in desert areas, and this is were we customarily think of reptiles living today, are inclined to be nocturnal, coming out only in the

(Continued On Following Page)

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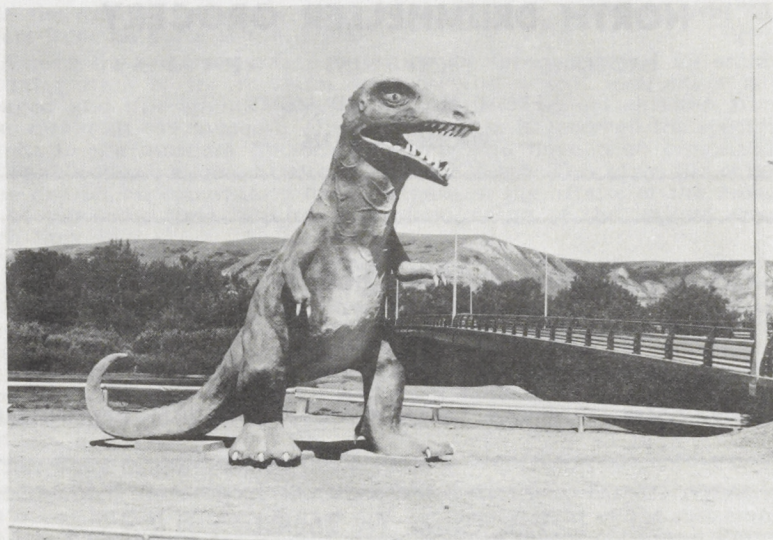
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cooler part of the day which is in early evening and in the early morning. In many instances the deserts are cold for them in the middle of the night and they again retreat under the rocks, where there is a degree of warmth. During the middle of the day when the sunbeats down on the desert no reptile can withstand this high temperature for very long. They lose control of their muscles, are unable to get out of the rays of the sun and simply lay down and 'stew in their own juice.'

Thus we may speculate along various interesting lines of thought. But with certainty we may say that the day of the dinosaur was over as the Cretaceous period drew to a close, and the future so far as reptiles were concerned was to belong to the relatively small animals that we know today, the lizards, snakes, turtles and crocodiles.



Tyrannosaurus Rex greets the visitors to Drumheller at the bridge over the Red Deer River.

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DRUMHELLER and DISTRICT MUSEUM SOCIETY

The Drumheller Museum is the local expression of the educational and cultural opportunities afforded by the unique and unsurpassed fossil remains for which the Drumheller Valley is famous. Despite the fact that many expeditions had removed dinosaur and other specimens from this area for over 50 years and displayed them in large museums around the world, until 1955 there had never been a sustained and organized effort to provide tourist or educational information at the source of these exhibits.

The nucleus of a museum was started in the Rotary swimming pool club house in 1955. The Museum Society was incorporated in 1957 and in 1960 moved to the present building.

The museum is to-day an educational agency, dedicated to creating an atmosphere of contemplation and creating intellectual stimulation while the visitors enjoy the exhibits. In 1962 we welcomed over 44,000 visitors from all parts of the world.

Among the most rewarding activities are those designed for children. The integration of the museum services with school instruction is encouraged and throughout the year bus loads of school children from a large area visit the museum. One display case is reserved for specimens brought to the museum by local children who have been organized as the "Pebble Pups" by the curator, Mrs. D. McVeigh. This gives the children of the district an opportunity to participate in the affairs of the museum and at the same time acquire an understanding of the unique area in which they live.

The Museum Society is deeply appreciative of the generous financial support of local citizens, business people, industries and service clubs. In addition many local workmen have donated free time and materials on many occasions. Without this whole hearted community support the museum could not have grown and flourished. Technical assistance has been received from the National Museum of Canada at Ottawa, the Glenbow Foundation of Calgary and the Canadian Museums Association, without which the Museum could not have reached its present development.

The following exhibits are on display:

1-Mounted skeleton of the duck-billed dinosaur EDMONTOSAURUS. This is our largest project to date and is the highlight of the museum, as such large specimens are usually found only in major museums. Preparation at the National Museum in Ottawa required 3062 hours over a period of three years. The specimen is conservatively valued at \$15,000.00. The skeleton was originally excavated near Drumheller in 1923 and mounted here in the winter of 1962. Edmontosaurus was the commonest dinosaur in this area. It frequented the bayoos and lagoons bordering the inland sea in the late Cretaceous and fed upon the lush tropical swamps of that time. It has been mounted in a natural swimming position because of its known aquatic habitat.

2-Four display cases depict the Geology of the Drumheller Valley and are arranged as follows:

GEOLOGY of the BADLANDS

The INLAND SEA

The PETRIFIED FOREST

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3-Pictures depicting the early history of this area.

4-Display of "Pebble Pups" specimens

5-Display of Mr. Hodgson's carvings.

Plans for the near future include:

1-Four display cases telling the "Story of the Dinosaurs".

2-Further display cases along the south side of the building depicting Ice Age materials, Indian artefacts etc.

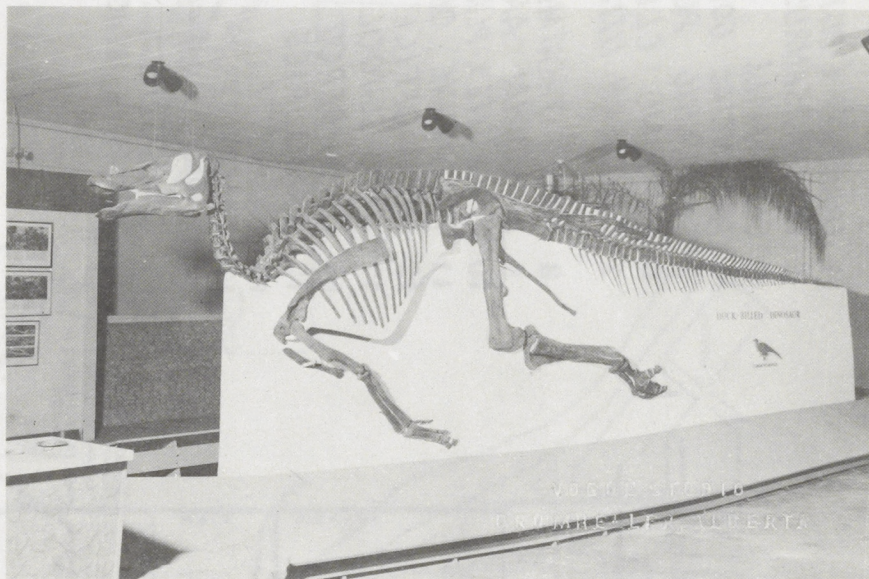


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DUCK-BILLED DINOSAUR EDMONTOSAURUS

The bones of the *Edmontosaurus* skeleton in the Drumheller and District Museum were discovered and collected by Dr. C. M. Sternberg, formerly of the National Museum of Canada in 1923. They were found about six and one half miles West of Munson in the East bank of the Red Deer River, some 150 feet above water level in Sec. 15, T. 30, Rge. 21 West of the 4th Meridian.



The skeleton is about average size for *Edmontosaurus*, or possibly a little smaller than average. In life the animal weighed perhaps four or five tons. The fossil bones weight about a ton. As mounted, the skeleton is 30 feet long and is about 8 feet high. When the animal stood on its hind feet the head may easily have extended 14 feet above the ground.

(Continued on Page 31)

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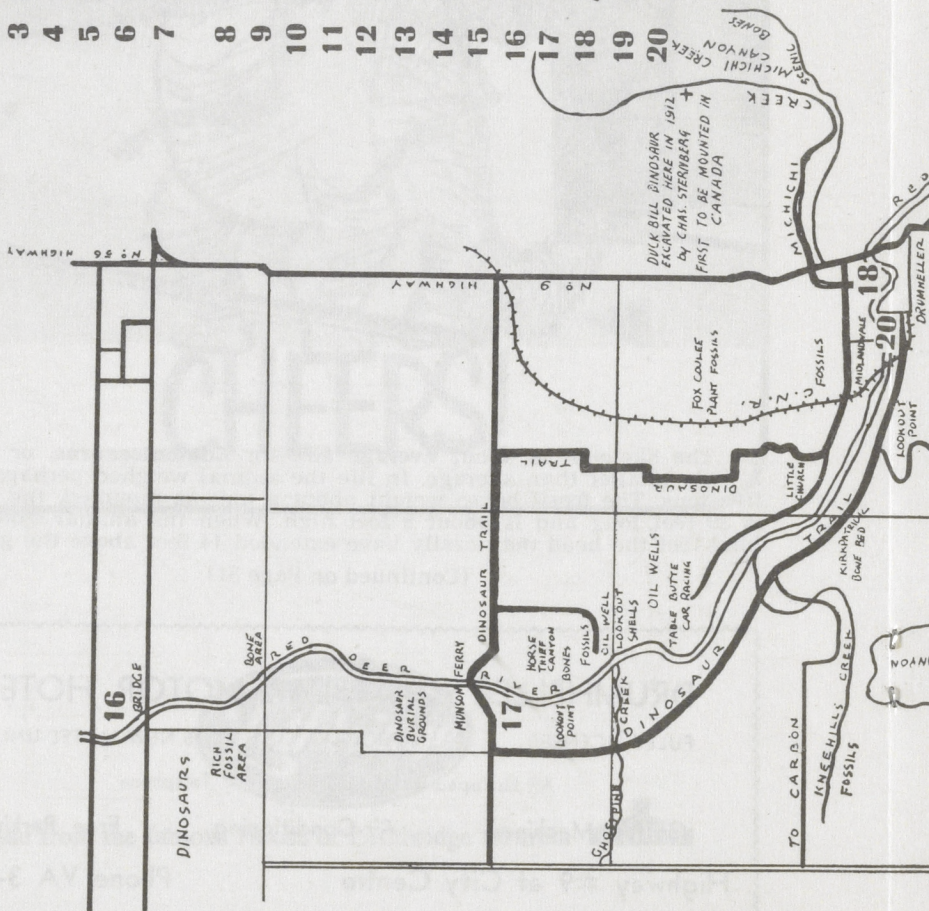
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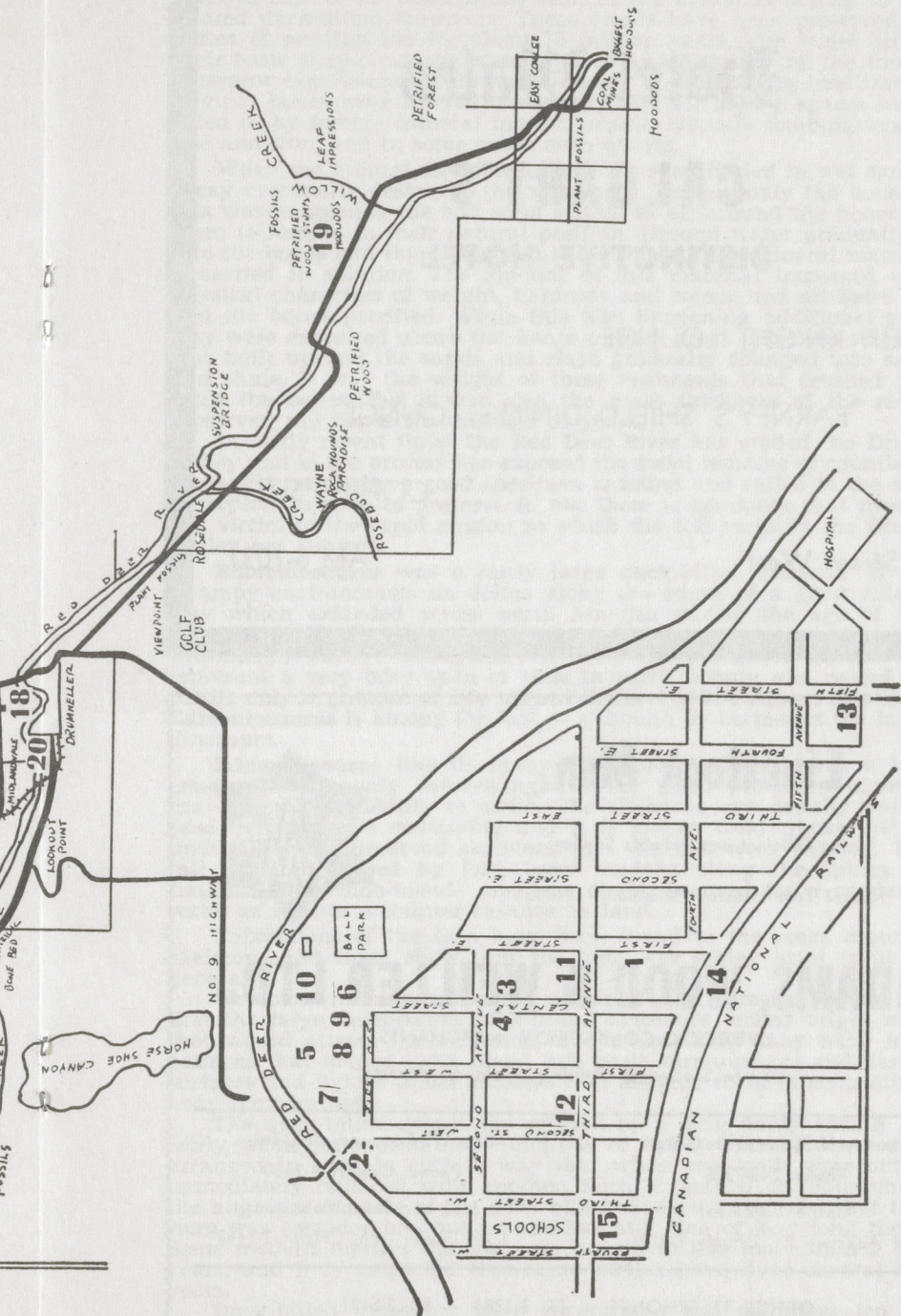
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Edmontosaurus is the common dinosaur in the Drumheller Valley. Perhaps 90% of all fossil bones seen in the badlands belong to this and related duck-billed dinosaurs. These fossils have been preserved by processes of petrification for about 75 million years. The bones still retain their basic shape, but are often crushed and distorted by the tremendous pressures experienced in the rocks during and following fossilization. The original bones were altered chemically and all hollow spaces have been filled in by foreign mineral matter, usually various combinations of calcite and iron, and in some cases even quartz.

When the animal died its carcass was soon buried in wet sand where decay eventually destroyed the soft parts leaving only the bones. While this was happening the soft sand settled in all around the bones causing them to remain in their natural position. Ground water gradually seeped into the bones and there began to leave some of the mineral matter which it carried in solution. The amount of this material increased until the physical characters of weight, hardness and colour had all been changed and the bones petrified. While this was happening additional sand and clay were deposited above the bones until a great thickness of sediments was built up and the sands and clays gradually changed into sandstone and shale. It was the weight of these sediments that crushed and distorted the bones. But it was also the great thickness of the rocks that preserved the bones for millions of years.

In fairly recent times the Red Deer River has eroded the Drumheller Valley and in the process has exposed the fossil remains of countless dinosaurs. Occasionally a good specimen is found and called to the attention of experts in time to preserve it, but there is no doubt that most fossils fall victim to the rapid erosion to which the soft rocks in the Drumheller Valley are subject.

Edmontosaurus was a fairly large duck-billed dinosaur. It lived in swampy environments on deltas along the edges of a great inland sea-way which extended across north America during the age of Reptiles. Some of the rocks deposited upon these deltas are now exposed in the Drumheller Valley. Geologists call them the Edmonton formation. They represent a very brief span of time in earth history and record in their fossils only a glimpse of life toward the end of the Age of Reptiles. Thus **Edmontosaurus** is among the last — although by no means the last of the dinosaurs.

Edmontosaurus like its many duck-billed relatives was a harmless creature whose only defence against the great predatory dinosaurs of the day was an ability to swim. The skeletons are usually found in a pose that suggests swimming and it is known from tracks and certain unusually well-preserved skeletons that the feet were webbed. The stiff tail — strengthened by long bony tendons along the spines — was flattened from side-to-side and was doubtless used for a rudder in the water as well as a counter balance on land.

Impressions of the skin have been found in the rocks around some skeletons and these show that the hide was scaly as it is in reptiles generally.

We know nothing about the colour of the animals, but we suppose that the large defenceless duck-billed dinosaurs lacked bright markings that would attract the attention of enemies. They may have had skin patterns that helped them blend into their surroundings and dark upper surfaces and lighter under surfaces that assisted them in controlling their body temperatures.

The duck-billed snout was covered by a long horny sheath and the fairly weak jaws contained hundreds of small teeth. These teeth were arranged in rows in such a way that when one tooth wore out it was immediately replaced with another. Such a method of replacement and the huge size of some of the duck-billed dinosaurs suggests that their life span was considerable, but no one has any idea of how long they lived. Some modern reptiles though, are known to live more than a hundred years, and it is suspected that some turtles have lived several hundred years.

Duck-billed dinosaurs were vegetarians and doubtless fed on soft plant material that must have been in copious supply in and around

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the swamps. The same materials provided the source for the coal of the Drumheller Valley. It is not unlikely that most feeding was done in the water, for not only did this environment provide protection from the non-swimming carivorous dinosaurs, it buoyed up the heavy bodies and literally took the weight off the dinosaur's feet. These feet and legs were none too well adapted to carrying great weight around on land; the joints were composed of relatively soft cartilage or gristle.

Duck-bill dinosaurs may have laid eggs, but if so, no shells have been found. This could be because the shells were leathery and thus subject to decay, or perhaps at egg-laying time, the dinosaurs left their swampy homes and migrated into drier and higher land. There the eggs would not likely become preserved as fossils because there is little chance of rapid and permanent burial where drainage is rapid. Remains of very young dinosaurs are very uncommon and even animals half the size of this skeleton are rare.

The bones used in this display were removed from the rock, cleaned, mended and mounted by Harold L. Shearman at the National Museum of Canada in Ottawa. The work required more than 3 years.

The skeleton was mounted in several sections which were shipped to Drumheller for assembly. The shipment weighed 8,000 pounds, boxed and crated. The project was supervised by Dr. Wann Langston, Jr., Curator of Vertebrate Palaeontology, National Museum of Canada.

Two questions frequently asked at the Museum are —

1. Why did so many dinosaurs die here?
2. How were the Badlands and this deep valley formed?

Only during the last 500 million years have plants and animals produced hard parts capable of being fossilized. If you look at the Geological Time Chart you will find that dinosaurs were the dominant form of life during the 120 million years of the Mesozoic era comprising the Triassic, Jurassic and Cretaceous periods. This holds true on all the continents of the world. By the close of the Cretaceous the dinosaurs had been replaced by the mammals, and only in comparatively recent times did man appear upon this earth.

Now its easy to see that the dinosaurs were deeply buried beneath the deposits of the following Cenozoic era, and with the exception of a few places in the world this holds true. The Valley of the Red Deer River is one of these exceptions. During the Great Ice Age this part of Alberta was heavily glaciated, which is to say, the advance of the glacial ice cut away the Cenozoic deposits; leaving the rocks of the late Cretaceous almost at the surface. As the ice melted, the water was added to the drainage flow from the mountains to the west, and this flow cut its way through the soft sediments in which the dinosaurs lie buried. Thus the exposures were created and our fossil wealth made easily accessible. Because these sedimentary rocks are soft they are easily cut and shaped by the sculpturing action of water, wind and frost. So it can be said that erosion shaped these Badlands as you see them and will continue to do so.

The Valley walls in the vicinity of Drumheller are composed of alternate bands of black, brown, grey and white layers of coal, ironstone, clay, shale and sandstone. These rocks are called the Edmonton formation by geologists and the fossils they contain tell us that they date from near the end of the Cretaceous period.

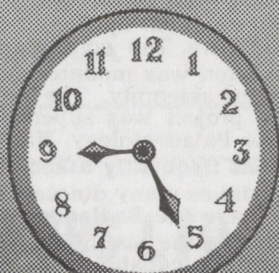
Sometimes we are asked "Have the dinosaurs all been found?" Quite obviously the answer is "no". As erosion continues its slow progress into the Edmonton beds more fossils will be exposed. Each new exposure may be a prospect leading to a new discovery.

Quite recently a partially exposed skull was found by members of the Museum Society. It was professionally excavated, collected and brought into the museum for safe keeping. It was subsequently identified by Dr. Wann Langston, Jr. of the National Museum as the skull of a *Pachyrhinosaurus canadensis*, a type of horned dinosaur never before found in the Edmonton beds. Because of its scientific significance it has been released by our Museum for study and reconstruction at the National Museum at Ottawa.

(Continued on Following Page)

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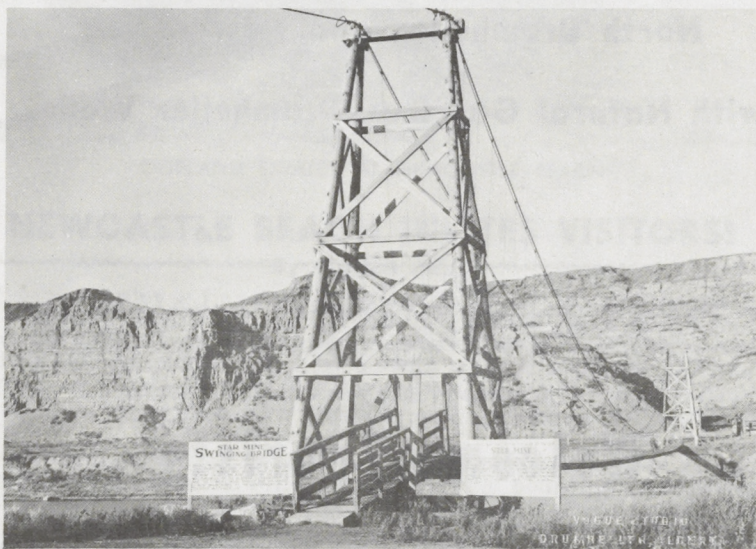


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Had the skull remained exposed to the weather it would have eventually disintegrated and been lost. Had an enthusiastic rock hound found it and chipped away fragments, it would have been ruined, and a page in the geology of the Edmonton beds would have remained unturned.

We well know that with so many thousands of Badlands visitors roaming these hills and coulees in search of petrified bone and wood as souvenirs or as raw material for their lapidary work, there is some confusion as to what may be picked up and kept. The pieces that have eroded out of their original position and are lying scattered at the base of the cliffs or in dry washes where they have been carried by run-off are of no value scientifically but are highly prized by the finder. But if you should find an exposure of bone obviously lying in its original rock bed **DO NOT TRY TO DIG IT OUT. MARK THE SPOT AND PLEASE REPORT IT TO THE MUSEUM.** We will have the location thoroughly investigated. Your name will be recorded as having made the find and your co-operation will be greatly appreciated.

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Located near Rosedale, spans 384 feet across the Red Deer River and is 4 feet wide. Built for use of miners working at the Star Mine. The mine closed in 1957 and the bridge is now a tourist attraction.

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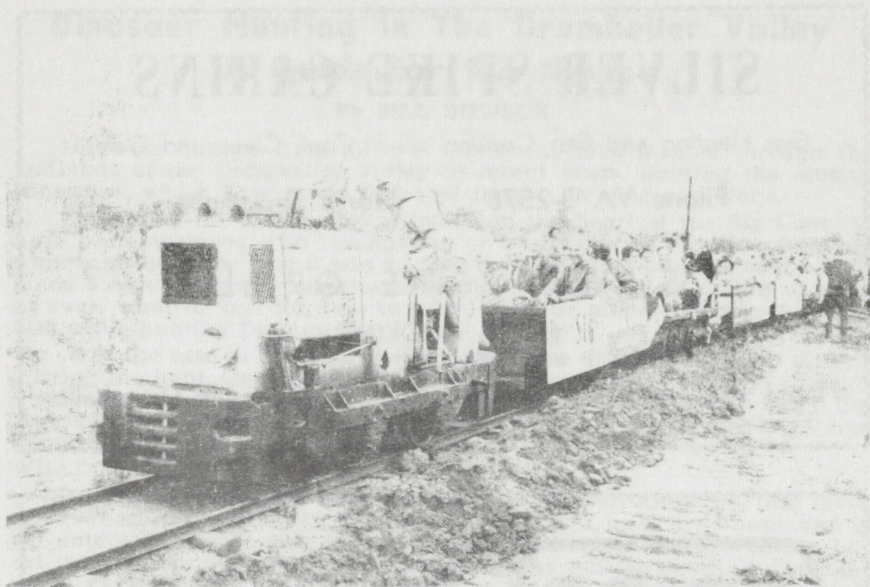
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By Marian Smith

You will enjoy a fine day at Newcastle Beach and Amusement Park. This a favorite swimming spot, noted for its wide clean sands and safe swimming area, Shelters, camp grounds and refreshment booths make it an ideal place to picnic and enjoy a swim while touring the Badlands.

Drive straight west of Drumheller for one and a half miles where you will see on your right a sign directing and welcoming you to Newcastle Beach.

After being confined in your car for what seems to them an endless journey, your youngsters will thoroughly enjoy bouncing on the trampolines; a ride on the Oopland Express, a round of Putt-a-way golf or perhaps a pony ride.

The Oopland Express was formerly a hard working Diesel unit hauling coal through miles of underground tunnels in a mine. When the mines closed, it was destined for the scrap heap along with hundreds of others of their kind. Battered and begrimed, the ten little cars were purchased, along with the locomotive, by a group of Newcastle residents who had little money, but a lot of enthusiasm and willing hands. Repaired, fitted with seats painted in gay colors; a mile or so of narrow guage railroad was built near the beach for them to run on, as well as a tiny station where the biggest little railroad begins and ends at the centre of the beach.

Newcastle beach is not a commercial venture. It is, however, a fine example of what one small, but enterprising community did with their portion of the recreational funds donated a few years ago to all Alberta communities.

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Dinosaur Hunting In The Drumheller Valley

A Guide for the Novice

By BILL DOWSON

Dinosaur hunters from all over the world have roamed through the Badlands of the Drumheller Valley in recent years, hunting the elusive Dinosaurs, which have made this area famous in song and story.

Citizens of the Valley City, situated in the heart of the Big Country, have been swamped with information on outfitting for the hunt from all corners of the globe, and it was decided that with this printing of the Badlands Booklet, a short guide should be published giving an outline of what to wear, what to look for, how to travel and the proper attitude to maintain while hunting Dinosaurs.

As is the case in Africa, different safaris use different methods of conducting the hunt. One may hire a guide locally to lead the safari through the badlands, or one may employ the assistance of natives to carry the necessary equipment and double as guides. This is by far the most economical plan.

WHAT TO WEAR:

It has been suggested by those who have hunted Dinosaurs, that these beasts react quite violently to purple, but this is a local hypothesis and is yet unproven by zoologists who have studied the area and its beasts. Local thinking is, that while the Dinosaurs may not be especially antagonistic toward purple, it is a good idea to play it safe and wear clothing that is either red, green or plaid. (Black Watch plaid is out, of course).

WHAT TO LOOK FOR:

Spoor tracking is by far the most popular method of trailing Dinosaurs, and this African method of hunting has been adapted locally to make the hunt more fruitful and more economical. One can readily imagine the cost of running about the Valley aimlessly in a car or on horseback waiting for the beast to show himself.

Dinosaur spoor is easily recognizable from other spoor in the Valley, and even the novice Dinosaur hunter should have no trouble in identifying it. **LOOK FOR:** Partly digested automobile bodies, water canteens, wet wash, neon signs, (most aggravating to the male Dinosaur), popsicle sticks and of course, purple clothing. During the summer months, the spoor may contain a high prospector hammer and pith helmet content, since these beasts have a fondness for iron and cork in their diets.

HOW TO TRAVEL:

The best method of travelling when hunting Dinosaurs is on horseback, but since the quarry has been sighted, it is wise to get off the horse very quietly, sneak into a Sagebrush patch until you are hidden from view and then run like a madman for town. Many think the 4-minute mile was broken by Dr. Roger Bannister, but this mark was shattered in 1917 by a George Glue, who made it from the Horseshoe Canyon to Drumheller in just under two minutes.

The Dinosaur is a very intelligent beast and he can tell when he is being pursued by a professional hunter with great ease. He can also tell when he is being pursued by an amateur and he doesn't like it one bit.

He is a meticulous, punctual animal by nature and likes to see a well-run safari with a clean, neat camp. He will not tolerate hunters who are late for appointments, or clumsy or lazy in camp. Every member of the safari must pull his own weight. Remember at all times that the Dinosaur appreciates being hunted by people with a professional air, and he will not put up with slip-shod tracking.

WHEN TO HUNT:

Twilight is the best time to hunt the Dinosaur, for at that time of day he is preparing for bed, after gorging himself liberally with prospectors hammers, pith helmets, people's laundry, neon signs (if he is male), auto-

(Continued On Following Page)

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mobiles and popsicles. There are two ways of nabbing him while he is making his bed. One method is to have one member of the group approach the Dinosaur from the front, holding a tid-bit in one hand (an old bumper or a fender work well) and enquiring the way to the Little Church or some other landmark well-known to Valley Dinosaurs. While the animal is pointing out the required directions (Dinosaurs are very courteous by the way), two other members of the expedition approach from the rear. One is carrying a telescope and the other a matchbox. While the one hunter views the animal through the big end of the telescope, the other deftly picks up the Dinosaur with a pair of tweezers and puts him in the match-box.

The second method, known as the Circular Approach, is not too popular, nor successful, but is a delight to those looking for excitement on the hunt. All members of the safari gather about the Dinosaur in a circle and they close in on the beast. When they are a few feet from him, they simply climb aboard and attempt to subdue the animal with blows from stockings with oranges in them. This is a great deal of fun, for those fortunate enough to be approaching from the rear. For those in front, especially those wearing pith helmets, it can prove to be a disastrous undertaking.

Shooting Dinosaurs with firearms is prohibited by law. These beasts must be taken alive, and transported from the Valley at the hunter's expense.

This abbreviated guide to Dinosaur hunting will no doubt be of great assistance to those coming to the Valley to bag a specimen.

It has been found that University Expeditions, and safaris organized by Museums and Exhibition Associations have had a great deal of success in hunting the Valley Dinosaurs. Their successes have been attributed to a great degree to the Dinosaurs gregarious nature. He is a friendly creature when not aroused, and appreciates a good home, and the constant admiration of visitors and students of Paleontology.

In closing, it should be stressed, that when hunting Dinosaurs in our Valley, one must keep one's tongue in one's cheek at all times. Good Luck!

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Industrial Co-ordinator

For The City of Drumheller, Alberta

INDUSTRIAL LETTER

Dear Tourists:

Re: INDUSTRIAL DRUMHELLER

Drumheller, since the turn of the 20th century has been a thriving coal mining metropolis. Drumheller has to date been chiefly an industrial town of a primary industry nature. The economy of the district has been kept at a high standard by the coal fields, agricultural area, and more recently by the highly productive oil and natural gas fields in the immediate district.

These secondary industries presently in Drumheller consist of those industries required to maintain the coal industry and the needs of the population of the valley.

Drumheller has not previously been favored by Federal or Provincial Governments as a location for institutions but due to the recent ebb in the coal industry a stabilizing influence in our economy and labor force will be brought about by the payrolls from the new Federal Government Minimum Security Penitentiary and the new Vocational School. These two new institutions should most certainly lead the way to more industrial advantages.

Drumheller can be and will be in the not too distant future an Industrial mecca of Western Canada due to its God-given natural resources and exceptionally convenient location to service the Prairie Provinces and their ever increasing population. Drumheller's natural resources consist in part of coal (of the highest domestic quality), shale, bentonite clays, gravel and sand, gas and oil, and the Red Deer River which is one of the West's few remaining unpolluted water supplies.

Drumheller is an established city with all of the desirable living conditions required by industries with complete Federal, Provincial and Municipal Government services of the highest standard, where both civic and provincial government welcome and assist industry.

Our transportation system leaves little to be desired as Drumheller is on the main line of the Canadian National Railways between Calgary and Saskatoon, daily return Dayliner service Drumheller to Edmonton, is serviced by the Canadian Pacific Railway and Alberta No. 9 Highway from Trans-Canada highway near Calgary to the Saskatchewan border, also Alberta Highways No. 10 and No. 56.

The telegraphic communications of both railways together with the Alberta Government Telephones, the Dinosaur Broadcasting Association and T.V. stations CHCT and CFCN Calgary, combine to equip Drumheller with one of the finest communication services available.

The industrialist establishing in Drumheller can feel confident that his labor force will find much satisfaction and contented living in Drumheller which has a School System next to none, medical and hospital facilities, a variety of well attended churches, lodges, service clubs, societies, recreational and cultural activities reaching far beyond any city of comparable size in the great north-west.

To the manufacturer of food products Drumheller offers an abundance of livestock, hogs, poultry, market garden products (including cantelope, tomatoes, cucumbers, corn), grains of the highest milling and malting qualifications, and a dexterous female labor force.

The citizens of Drumheller are proud of their prehistoric wonder-land and invite you to join us in work and play.

Yours very truly,

—C. L. SWAIN,

Industrial Co-ordinator for
City of Drumheller.

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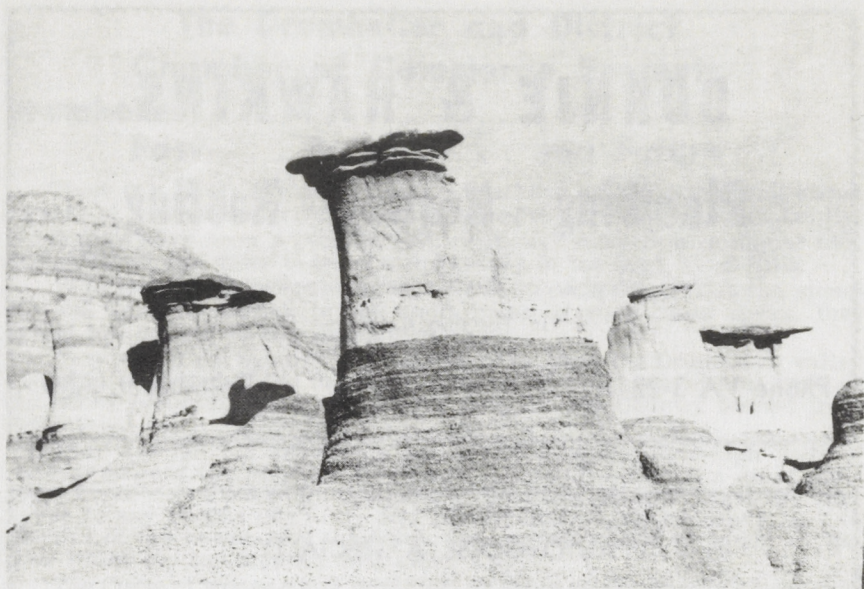


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HOODOOS

The rock layers exposed in the Red Deer Valley walls are composed of different materials such as sandstone, shale, clay ironstone and coal. Since these rocks differ greatly in hardness some of them resist erosion better than others. The harder rocks are usually thinner than the softer ones in this particular region. When the hard layers are undermined by the erosional activity of wind, running water, freezing, thawing and so on, the harder layers tend to remain as protection for the softer rocks below as erosion progresses however, the softer rocks and then the protective harder tops become separated from the adjacent rock masses and this often results in a sort of gigantic "toad-stool" structures that have been termed Hoodoos. Hoodoos are a characteristic feature of badlands everywhere and may vary in size from tiny structures a fraction of an inch in height to massive pillars as tall as buildings. Some good examples of Hoodoos can be seen at Willow Creek where resistant sandstone layers at the base of the Edmonton formation cap pillars of softer and more easily eroded shale of the Bearpaw formation.

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There is a small ring of bleached stones high on the valley wall above the city of Drumheller, which once contained the fire of an Indian family.

It may have been a cooking fire, or it may have been a signal fire, calling across the miles to friends and family in the high Hand Hills.

Whatever the reason for the fire we will never know. But the stones remain, partially buried in the short grass. If they could speak, they would tell us part of the Drumheller story.

They would not be able to tell of the days when the Drumheller valley stretched westward to the Pacific Ocean, nor of the upheaval that gave us the Rocky Mountains and cut the heart of the Big Country forever from the sea.

They are not old enough to tell of the creeping mile-high wall of ice that scraped the province clean with the ruthlessness of a giant bulldozer blade . . . the ice that by-passed the Hand Hills in a gesture that seems to say to this day" . . . and this mound of earth I leave you, to tell you of my power, and show you the original height of land . . . the land which did not stop me and never will".

The Circle of stones could never tell us about the legendary beasts that snuffled and grunted among the reeds, nor the reptiles that flew, nor the mystery that murdered each and every one.

But the stones would be able to recall the day a small bearded man in buskins peered over the valley wall in disbelief and awe. The year was 1792 and the man's name was Peter Fiddler. He had no idea a valley lay before him as he treked across the bald prairie searching for the skins of beaver and the sparkle of gold. He did however record his find, and we must award him the honor of being the first white man to walk the floor of our valley. Perhaps he wasn't. Who knows what moccasins or high leather boots travelled this tortured valley before him? But we say Pete was first.

Pete didn't stay long. He didn't even winter here. He stayed in a fort which was built at the confluence of the Red Deer and South Saskatchewan Rivers, now the location of Empress.

After Peter, who knows how many fires were lit within the circle of stones? How many buffalo tongues sizzled over the coals lying up there, and how many years went by till the valley was "discovered" again. The stones of course don't know. But we do. Officially, the first settler in the valley was Tom Greentree, and he came just after the turn of the century, about 110 years after Peter Fiddler walked down the slope and stood chewing a piece of grass right about where the Diana Lunch is today.

Other men followed Tom Greentree; farmers and ranchers mostly. They formed a loose-knit society on the floor of the valley an enjoyed life in the pioneer style.

Then, as the circle of stones well knows, along came Sam Drumheller. Sam had a pocketful of the coin of the realm. He sat down with Tom Greentree and the boys, and when they left the bargaining table, Sam owned the townsite . . . lock, stock and cottonwood trees, That was 1910.

The last fire had been lit within the circles of stones, the buffalo were gone, and so were the hunters. And the city of Drumheller was being built slowly but surely. It was to be a construction job that went in fits and starts.

The locomotive whistle blast first bounced off the valley walls in 1911 when the CNR laid rail along the valley floor and halfway up it's

(Continued on Following Page)

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walls. The CPR came a year later, and as the coal trains lumbered out of the valley flexed their muscles on the upward climb, the thunder of their passing made the circle of stones tremble just a littel.

In 1914, the trains carried the young men in khakhi past the stones.

A few of them never saw their valley again, the valley that was slowly emerging as one of the giant mining complexes in the west.

Drumheller got it's municipal hospital in 1919, the year after the rest of the boys came home . . . and the coal trains scuttled back and forth cross the valley floor. There were strange voices being mouthed between the valley walls in those years up to 1930 . . . Yugoslavian, Ukranian, Swedish, Hungarian, German, Scottish, Welsh . . . stranger voices than these heard from the bronzed men who had huddled over the circle of stones so many years before.

Now it was 1930, and Drumheller had been incorporated as a city, but with belts tightening all across the land fewer trains huffed their way out of the valley.

The stones would say there was a quietness in the air those days, and it was not until more young men in khakhi rolled out of Drumheller in the long troop trains that the miners lamps flickered again underground in great numbers and laughter rolled across the valley floor from the open pub doors.

Days were busy, nights were busier. Steel claws ripped the coal from its mooring place, trains tiny cars rumbled out of openings in the valley floors and walls, hordes of dusty-faced men tramped into the openings and hordes tramped out as shift followed shift in an apparently endless cycle. If you had walked in the past, you now took a cab. If you took a loaf of stiff bread to work with you last year, now you took three meat sandwiches. These were good. Very good. And then, the train rolled back in from the outside world carrying the young men in khakhi.

With their arrival, the trains became fewer, there was less meat in the lunch buckets and the pubs were quiet in the night. The circle of stones saw all of this.

Just as with a large banquet, when the guest have shouldered their way laughingly into their coats and departed, full of the fruit of the table and punchbowl, so it was with Drumheller.

The coal was not wanted. Those who mined for their existance had gone their way, leaving the banquet tables to be cleared by the hosts. The hosts at this banquet were the people of Drumheller, who had to stay when the party was over, who had to clear the tables and decide whether banquets were a good idea.

Today, as the stones might tell us, were they not mute observers, there is no banquet. Neither is there stiff bread. There is a quiet activity in Drumheller, born by those who stayed, being raised to maturity for those who will come.

Drumheller today is the administrative centre of a tremendously large area. It is the site of a new vocational school, right beneath the circle of stones. It will be the location of a federal penitentiary. It is the home of many new business, new homes, new mediums of communication, and new ideas.

No banquet. But many people sup at our table. Farmers, Ranchers, construction men, oil workers ,miners, business people and their staffs, teachers ,and educators.

As there is no banquet, there is no fine linen. Drumhellerites say "You have to **want** to live in this town". That could be true of any town, or city. Ours is a quiet city, growing steadily with the amenities of a solid community, but none of the blare and gaiety of a boom. Or a banquet. Drumheller cleared the table twice after acting as host. Now it is a sedate matron, inviting all and feting none.

What will the circle of stones see in the future? Will it see a sudden rushing of industry to the valley? Probably not. We know it will see it's share of industry, and we know that our young people training themselves in our new school will fit into any industry that settles here.

(Continued on Following Page)

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Will Drumheller turn into a Disneyland overnight? Probably not. The number of tourists who visit the valley each year increases fantastically, and yet there is room for all without the jostling and shouting that goes with a vacation centre turned into a carnival. The Drumheller valley is as quiet as it's fossilized dinosaurs.

We will see Drumheller become an educational and administrative centre and we will see it serving more and more agricultural and livestock people. It will be home for 15,000 residents in the not too distant future, and it's trading area will gradually increase to absorb the smaller towns surrounding it. This is happening now.

Will someone suddenly find a universal application of coal as a fuel or component in industry? Perhaps. If this happens, it will be included in Drumheller's assured future. If it does not, that will be fine too. We are not planning on this blinding news from the laboratory.

"Drumheller can't grow sideways", say the oldtimes. It has grown east and west considerably in the last five years, but a few more families will strain the city limits. It is then that Drumheller will climb the valley walls. There is something prophetic about this. As the mammals crept from the sea to rise to better things, so Drumheller will creep towards the rim of the valley, and the sun. Leaving behind the fossilized remains of the amoeba who stayed in the sea.

And one day soon a shiny grader blade will push aside the circle of stones that watched our city grow for so many, many years.

THE END

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## **WAYNE — THE BADLANDS OF THE ROSEBUD CREEK VALLEY**

**By T. H. HANSON**

A side trip for lovers of fossil-hunting is the Wayne section of the Badlands. Turning south by car from Rosebud, one winds between 450 feet high hills which seem much higher because the Rosebud Creek Valley is so narrow. The road crosses and recrosses the creek many times indicating a rather high cost of building eleven bridges in the distance of three miles.

The first sight of Wayne make it rather hard to imagine a thriving town of forty years ago supporting a large population and four large coal mines. Little is left as evidence of the prosperity it once experienced.

However, evidence of an even mightier age remain and from here the trip is on foot. The Wayne valley is criss-crossed by deep coulees which are a fossil-hunters delight — if he wishes to work for his prizes. Much climbing and walking are necessary for a successful trip. The Home Coulee, which enters the valley at the centre of the town seems to be the best place to pick-up a wide variety of fossilized marine life. These are washed to the floor by spring run-off and include samples of mollusks, echinoids and corals.

In smaller coulees, bones, dinosaur's teeth and sharks teeth can be found exposed and highly polished from years of weathering. Large leg and thigh bones, rib bones and flat grinding teeth of the mighty monsters are found each year. These dinosaur fossils are located some distance up from the valley bottom and because of the difficulty of the climb the hills have hidden their secret over the years.

Beyond the town of Wayne, along the C.N.R. tracks towards Calgary, fossils in an excellent state of preservation have been found lying on the river bottom during the dry season. No road is to be found into this section so most of the beds have remained undisturbed by man. Truly this rough, rugged and seemingly uncivilized part of the valley transports one's imagination back 90 million years into the past when the animal world reigned supreme.



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## OUR LITTLE CHURCH

BILL DOWSON

All of us, no matter what our religious beliefs or church affiliation, find that expressing ourselves to God is sometimes a difficult task. We pray in our churches or in the out of doors. We teach Sunday School or pick flowers from the garden for the church pulpit. We sing in the church choir or we spend a little time each day reflecting on the things the Lord created for us on our planet. Or we make a child smile or visit a sick friend. In these ways and the many others in which we express our gratitude to God, we are in actuality thanking him for the gift of life and the living of it.

The little church in our valley was built by men who, through their own skill and imagination, were expressing their thanks to God.

The sign painter laid aside his coarse brushes and tracing paper to take in his hand the soft brush and the oil paints with which he transferred stories from the Bible to the glass of the church's windows.

The construction man laid down the blueprint and the level, and took into his hands, which have been toughened by years of working with concrete and steel; the hammer; and with his knowing touch helped to build the church. The men that helped him, drove the nails with a skill they could not have acquired in their jobs for they were clerks, shopkeepers and men of business.

The minister that helped in the building laid aside his coat and Bible to carry shingles and lumber, for he is a builder too.

And when the bell was hung in the steeple and the little church gleamed brightly finished in the sun, these men; each of them; knew that he had not just helped build a church, but had assisted in erecting a tribute to the Almighty.

Not one man said this to another, but each one knew. For we all express ourselves in different ways to God and men don't discuss these things aloud.

So our little church, which seats 100,000 six at a time, is more than a pretty landmark, more than a tourist attraction. It is an expression of thankfulness for that is the kind of men these are.



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## Calgary Brewery Displays Most Interesting

The way to attract tourists is simply to have something to show them when they get here! And indeed, that's exactly what the Calgary Brewing and Malting Co. Ltd. has been doing for many years. The Gardens at the Brewery were first in line of development . . . and the planning commenced. Pools, streams, flowers and shrubs soon took shape — and one of the beauty spots of Calgary was born. For many years it was the practice of families here in town to "walk down to the Brewery on a Sunday afternoon" — and there they'd view the lovely flowers and see the pools of splendid fish. Many would stop in on their way to the Calgary Zoo — located just a few blocks from the Calgary Brewery. There they'd look at the realistic castings of dinosaurs and other large reptiles that roamed this part of the country many millions of years ago. The Drumheller Valley was the source of these fossilized bones which formed the skeleton outlines for the early paleontologists — thus giving them an idea of animal life on our planet millions of years before man appeared.

The next step was the introduction of the fish hatchery. In time the Brewery turned the staffing and operation of the hatchery over to the Provincial Department of Lands and Forests — while they continued to supply the premises and equipment. The benefits to Albertans have been many, thanks to this arrangement. In the first place, our lakes and streams would be "fished out" in a short time if left alone . . . but now, due to the stocking that takes place, there's no chance of that happening. Since the project originated, the hatchery has produced almost 100 million fish yearlings, fingerlings and eyed-eggs for planting in provincial waters. Thus, the Brewery has made an important contribution to the welfare of all Albertans along with bringing pleasure to our tourist friends. As a matter of fact, this hatchery is one of the largest on the continent, thereby guaranteeing good fishing for years to come.

Along with the beauty of the Gardens at the Calgary Brewing and Malting Co. Ltd., the hatchery has lent itself to additional programmes — it led directly to the Aquarium — the only one on the prairies! The Calgary Aquarium has both fresh and SALT water specimens on view — truly a wonderful development. The Aquarium opened in August 1960 — and the building alone cost \$450,000 — all built and provided by the Calgary Brewing and Malting Co. Ltd. Since 1960 a million visitors have been through the Aquarium! An extensive circulating, filtering, heating and refrigeration system supplies the 67 tanks with either fresh or sea water as is required. Nearly 50,000 gallons of sea water were trucked in from the Pacific ocean to supply the salt water system initially. This amazing feat caused considerable interest all over Alberta and in other prairie locations. In the Aquarium, exotic specimens are on display with sea horses, piranha, electric eels, elephant-nosed fish, Siamese fighters, sea turtles and a wonderful variety of fish from tropical waters that you would never expect to see. Anglers in particular enjoy the native game fish displays — because they get a good close look at the fish they are going after. These are all species of trout, pike, perch, pickerel, Arctic grayling, sturgeon and rocky mountain whitefish — native to Alberta. Game fish such as goldeye and bass from other parts of Canada are also on exhibit. You'll also see a reptile exhibit that is also open to the public without charge. There are snakes, lizards, boa constrictors, all in glass cases . . . and there's a specially designed pit for the four alligators! This is truly a spine-tingling display.

A visit to the Calgary Brewing and Malting Co. Ltd., is a "must trip for everyone. You'll be wise to allow an afternoon for this tour — because you'll see the gardens — the Aquarium — do the plant tour — and see the thrilling new "Horseman's Hall of Fame" — the latest addition to the Brewery family of public service projects. This display gives you an idea of the role played by the horse in the development of the west — and the intrepid men who practically lived on them. These men — their hopes

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and dreams pinned on the future of the west — will live forever in the annals of Canadian history. The Horseman's Hall of Fame contains artifacts of the early west — and there are lifelike figures made of papier mache that are extremely realistic. The figures depict the men and events that shaped the early west. You'll find Chief Crowfoot — interpreter Jerry Potts — David Laird, Lieut. Governor of the North West Territories — Col. James F. Macleod — and many others, including famous Indian Chiefs, signers of the Treaty Number 7. There are settlers, mounted policemen — a relief map of Alberta — and so many other interesting and educational items that you'll want to come back again and again.

Because of all these public service projects, it's easy to see the interest taken by the Calgary Brewing and Malting Co. Ltd. in Alberta — its past and present. The Brewery has also had a close association with the petroleum industry — using natural gas as the fuel source used to heat the automatic low pressure boilers, the grain driers and tremendous copper kettles. The grain growing industry is represented in the use of barley used in the beer making process they choose high grade malting barley produced exclusively in Western Canada. And the cattle raising industry is benefited by the provision of high-protein cattle feed — derived from the discarded dried grains from the manufacturing process. Yes, the Calgary Brewing and Malting Co. Ltd. is interested in making Alberta a great province — and they're proud of the achievements that have taken place over the past fifty years or more. All displays provided by the Calgary Brewing and Malting Co. Ltd. are open to the public daily without admission charge. Make sure you make this one important call when you're in Calgary.

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## APPRECIATION

The seventh annual edition of the Badlands of the Red Deer River is now in circulation.

The continued and increased support of the advertisers, the Alberta Travel Bureau and the City of Drumheller has made it possible to increase the number of books printed from three to ten thousand over the period.

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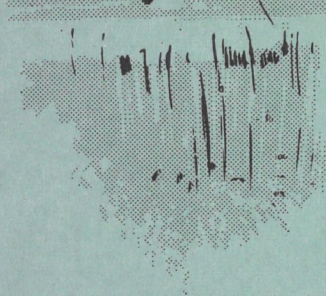
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